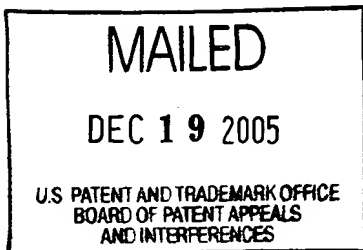


The opinion in support of the decision being entered today was **not** written for publication and is not binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**



Ex parte Alberto Borgonovo

Appeal No. 2005-1881
Application No. 09/836,637

ON BRIEF

Before RUGGIERO, DIXON, and MACDONALD, **Administrative Patent Judges**.
DIXON, **Administrative Patent Judge**.

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection of claims 1-5, which are all of the claims pending in this application.

We REVERSE.

BACKGROUND

Appellant's invention relates to a cabinet for audio devices. A copy of claim 1 under appeal is set forth below.

1. A cabinet for an electronic device equipped with a loudspeaker for audio reproduction characterized in that said cabinet comprises a main cabinet for housing electrical and mechanical components of the electronic device and further comprises a loudspeaker cabinet for said loudspeaker, said loudspeaker cabinet being separate from said main cabinet and connected to the outside of the main cabinet in a non-detachable manner.

The prior art reference of record relied upon by the examiner in rejecting the appealed claims is:

Kunimoto

6,335,974

Jan. 1, 2002

Claims 1-5 stand rejected under 35 U.S.C. § 102 as being anticipated by Kunimoto.¹

Rather than reiterate the conflicting viewpoints advanced by the examiner and appellant regarding the above-noted rejections, we make reference to the answer (mailed Jan. 27, 2005) and the final rejection (mailed Oct. 8, 2003) for the examiner's reasoning in support of the rejections, and to the brief (filed Sep. 7, 2004) for appellant's arguments thereagainst.

¹ We additionally note that dependent claim 5 appears to have improper dependency and should depend from claim 2 or claim 4 should depend from claim 2 for proper antecedent basis for "the vibration dampening means."

OPINION

In reaching our decision in this appeal, we have given careful consideration to appellant's specification and claims, to the applied prior art reference, and to the respective positions articulated by appellant and the examiner. As a consequence of our review, we make the determinations which follow.

Appellant has elected to group the claims together. (Brief at page 3)

Therefore, we will select claim 1 as the representative claim. Only those arguments actually made by appellants have been considered in this decision. Arguments that appellants could have made but chose not to make in the brief have not been considered. We deem such arguments to be waived by appellants [see 37 CFR § 41.37(c)(1)(vii) effective September 13, 2004 replacing 37 CFR § 1.192(a)]. We will consider the appealed claims separately only to the extent separate arguments for patentability are presented. Any dependent claim not separately argued will stand or fall with its base claim. **Note In re King**, 801 F.2d 1324, 1325, 231 USPQ 136, 137 (Fed. Cir. 1986); **In re Sernaker**, 702 F.2d 989, 991, 217 USPQ 1, 3 (Fed. Cir. 1983).

35 U.S.C. § 102

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.

Verdegaal Bros. Inc. v. Union Oil Co., 814 F.2d 628, 631, 2 USPQ2d 1051, 1053

(Fed. Cir.), **cert. denied**, 484 U.S. 827 (1987). The inquiry as to whether a reference anticipates a claim must focus on what subject matter is encompassed by the claim and what subject matter is described by the reference. As set forth by the court in **Kalman v. Kimberly-Clark Corp.**, 713 F.2d 760, 772, 218 USPQ 781, 789 (Fed. Cir. 1983), **cert. denied**, 465 U.S. 1026 (1984), it is only necessary for the claims to "'read on' something disclosed in the reference, i.e., all limitations of the claim are found in the reference, or 'fully met' by it." While all elements of the claimed invention must appear in a single reference, additional references may be used to interpret the anticipating reference and to shed light on its meaning, particularly to those skilled in the art at the relevant time. **See Studiengesellschaft Kohle, M.B.H. v. Dart Indus., Inc.**, 726 F.2d 724, 726-727, 220 USPQ 841, 842-843 (Fed. Cir. 1984).

Anticipation is established only when a single prior art reference discloses, expressly or under the principles of inherency, each and every element of a claimed invention as well as disclosing structure which is capable of performing the recited functional limitations. **RCA Corp. v. Applied Digital Data Systems, Inc.**, 730 F.2d 1440, 1444, 221 USPQ 385, 388 (Fed. Cir.); **cert. dismissed**, 468 U.S. 1228 (1984); **W.L. Gore and Associates, Inc. v. Garlock, Inc.**, 721 F.2d 1540, 1554, 220 USPQ 303, 313 (Fed. Cir. 1983), **cert. denied**, 469 U.S. 851 (1984).

Appellant presents a single succinct argument with which we agree. Appellant argues that

Kunimoto does not describe or suggest an electronic device having a cabinet including a main cabinet for housing electrical and mechanical components of the electronic device, as well as a loudspeaker cabinet that is separate from the main cabinet and is connected to the outside of the main cabinet in a non-detachable manner. In particular, Kunimoto only teaches an acoustic apparatus having a cabinet including woofers and tweeters positioned within such cabinet and adjacent to a cathode ray tube. Therefore, appellants' submit that claims 1-5 are not anticipated by Kunimoto.

From our review of the teachings of Kunimoto and the structure illustrated in the figures, we are in agreement with appellant, and do not find that Kunimoto teaches a "loudspeaker cabinet for said loudspeaker, said loudspeaker cabinet being separate from said main cabinet and connected to the outside of the main cabinet in a non-detachable manner." Here, we find that while the loudspeaker cabinet may be deemed to be separate from the main cabinet and may be connected in a non-detachable manner, the loudspeaker cabinet is connected to the inside surface of the main cabinet and not to the outside of the main cabinet as recited in the language of independent claim 1.² Therefore, we cannot sustain the rejection of independent claim 1 and its dependent claims.

² While we do not sustain the rejection of independent claim 1 over Kunimoto, we direct the examiner's attention to older audio and/or visual cabinets formed out of wood and other materials which may have had separate housings. Additionally, we note that US Patent 6,484,019 to Aklain teaches a keyboard with speakers 2 and 4 which appear to be attached to the housing of the keyboard and radio. Additionally, US Patent 6,243,473 to Azima teaches a laptop with hinged speakers. Copies of both are attached to the decision. We leave it to the examiner to consider the applicability of these references to at least independent claim 1.


Appeal No. 2005-1881
Application No. 09/836,637

CONCLUSION

To summarize, the decision of the examiner to reject claims 1-5 under 35 U.S.C. § 103 is REVERSED.

REVERSED

Joseph F. Ruggiero
JOSEPH F. RUGGIERO
Administrative Patent Judge


JOSEPH L. DIXON
Administrative Patent Judge


ALLEN R. MACDONALD
Administrative Patent Judge

BOARD OF PATENT
APPEALS
AND
INTERFERENCES

JLD/gjh

Appeal No. 2005-1881
Application No. 09/836,637

Thomson Multimedia Licensing Inc.
Patent Operation
Two Independence Way
P. O. Box 5312
Princeton , NJ 08543-5312



US006484019B1

(12) **United States Patent**
Aklia

(10) Patent No.: **US 6,484,019 B1**
(45) Date of Patent: **Nov. 19, 2002**

(54) **COMBINED COMPUTER KEYBOARD AND RADIO APPARATUS**

(76) Inventor: **Mannix V. Aklia**, 29 Miller St.,
Somerville, MA (US) 02144

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/420,446**

(22) Filed: **Oct. 18, 1999**

(51) Int. Cl.⁷ **H04B 1/06; H05K 11/00**

(52) U.S. Cl. **455/344; 455/556; 455/347; 345/168**

(58) Field of Search **455/556, 557, 455/344, 347, 348, 349, 350, 351, 550, 343, 346, 572, 90, 128, 66; 341/22; 345/168, 169**

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,481,382 A * 11/1984 Villa-Real 455/556
5,375,165 A 12/1994 Haber
5,617,474 A * 4/1997 Ditzig et al. 455/550
5,717,430 A 2/1998 Copland et al.
5,892,503 A 4/1999 Kim

5,900,867 A * 5/1999 Schindler et al. 345/327
5,926,170 A * 7/1999 Oba 341/22
5,929,774 A * 7/1999 Charlton 455/556
6,011,495 A * 1/2000 Chen 341/22

* cited by examiner

Primary Examiner—Vivian Chin

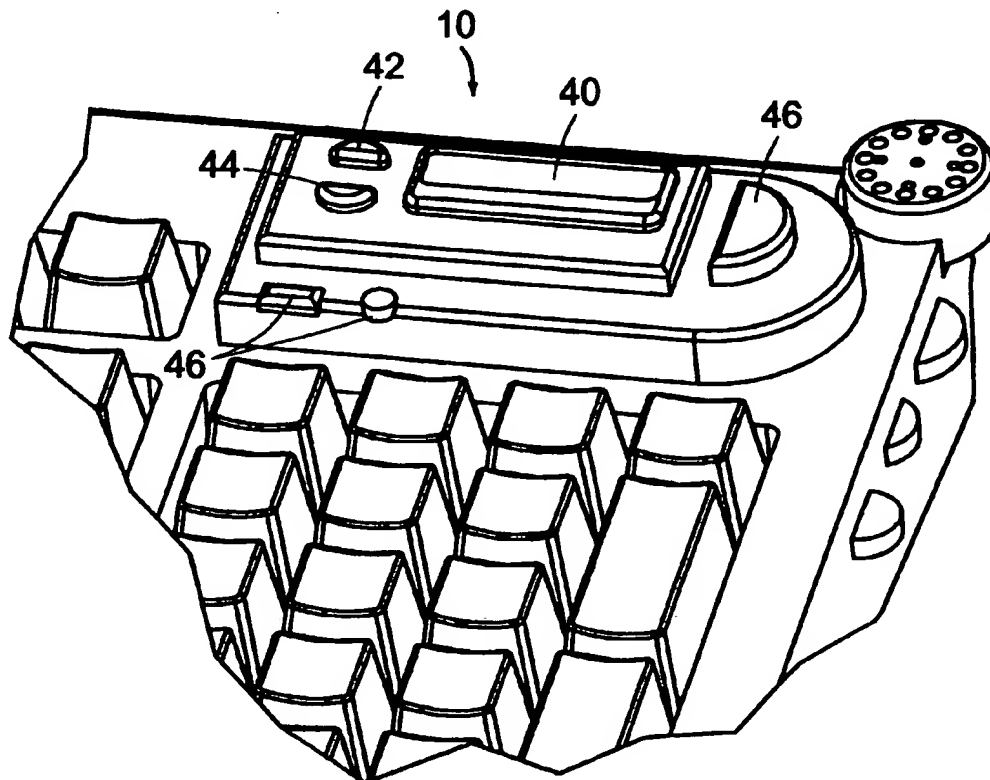
Assistant Examiner—Eliseo Ramos-Feliciano

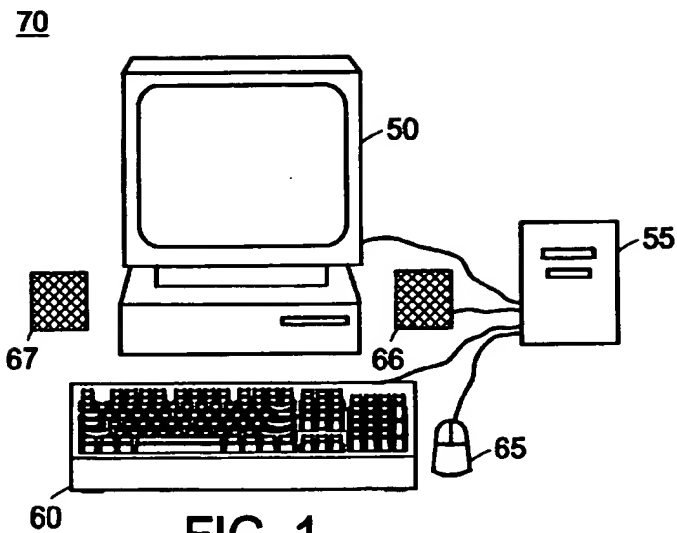
(74) *Attorney, Agent, or Firm*—Lambert & Associates;
Gary E. Lambert; Edward Timmer

(57) **ABSTRACT**

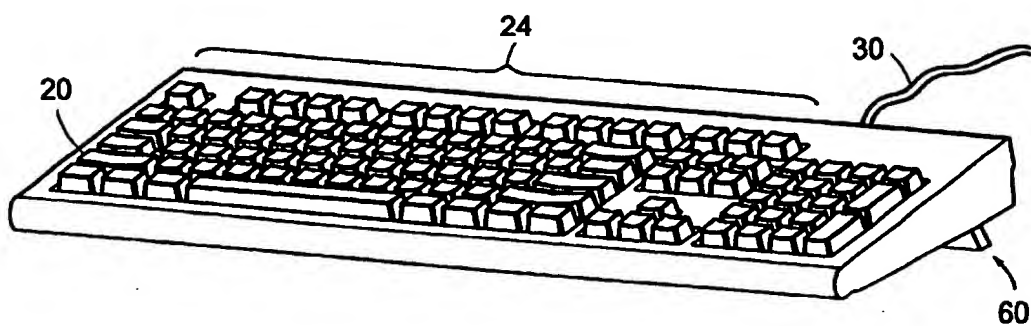
A combined computer keyboard and radio apparatus for use with a computer having a CPU contained in a housing comprising a keyboard housing, the keyboard housing is separate from the computer CPU housing and a plurality of alphanumeric keys are mounted in said keyboard housing, a selectively tunable radio unit located in the keyboard housing having circuitry isolated and independent of the keyboard circuitry and at least one speaker mounted within said keyboard housing for audibly reproducing the radio frequency waves received by said radio receiver whereby the radio unit may be played for the listening pleasure of the user without impacting, using or otherwise impacting the resources of the computer to which the combined computer keyboard and radio apparatus is interfaced.

11 Claims, 3 Drawing Sheets



**FIG. 1**

PRIOR ART

**FIG. 1A**

PRIOR ART

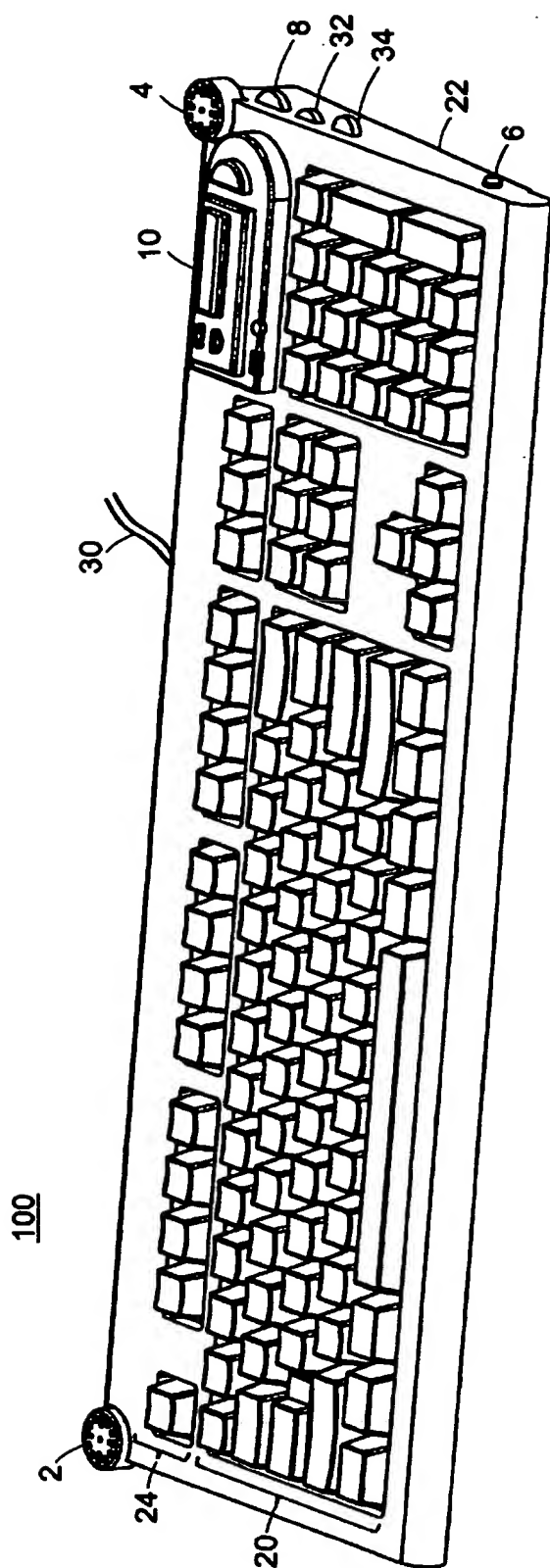


FIG. 2

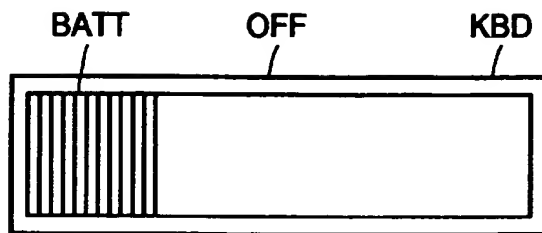


FIG. 3

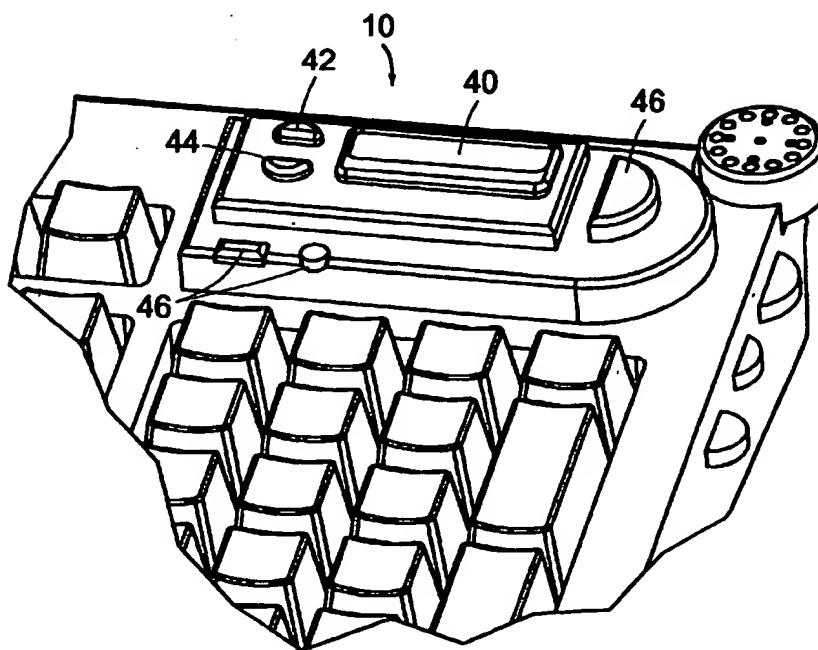


FIG. 4

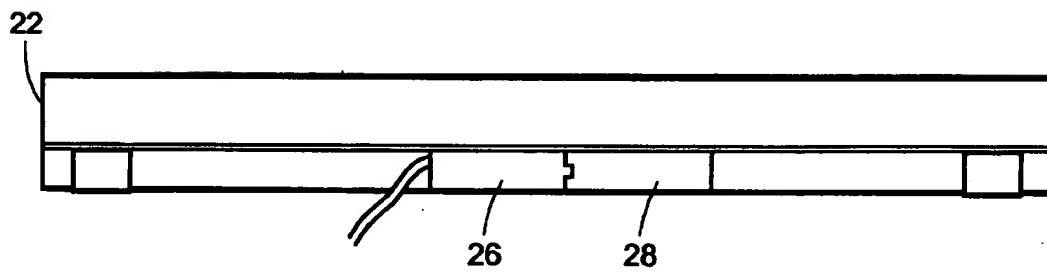


FIG. 5

COMBINED COMPUTER KEYBOARD AND RADIO APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to computer keyboards. More particularly, this invention relates to an apparatus of a combined computer keyboard and a radio in a single unitary housing.

Personal computers have gained great popularity in recent years. The evergrowing popularity of personal computers is so pervasive and widespread that personal computers have become viewed as a necessary and "must have" item. Personal computers occupy a great percentage of office desks and homes as well. Although personal computers were originally designed as a tool to accomplish specific work tasks such as calculating and word processing, their role has expanded to include entertaining and gaming as well. While the use of personal computers for entertainment purposes such as playing games or editing photos and home movies has expanded, the personal computer is still used for the mundane and not-so-exciting tasks of tracking finances, word processing, calculating and editing spreadsheets and the like by most people—at least part of the time that they use their PC. Many people have a desire to listen to music as they work, at a computer or otherwise. For many people, listening to music while working is both comforting and relaxing.

While there are numerous hardware and software products that interface with computers enabling the computer to play and edit music, most of these products use at least a portion of the computer's resources and/or are cumbersome to install and use. The available hardware and software is usually installed in or attaches to the computer as an add-on peripheral feature. In either case, the hardware and software typically uses some of the computer's resources such as memory and/or power. Hardware externally attached to the computer, for the most part, is connected to the computer via cables. Cables are unsightly and difficult to neatly manage. Even when using hardware components that communicates with the computer via wireless communications means, the hardware components still use valuable desktop real estate. Additionally, the typical computer add-on must be accounted for by the host computer. Utilizing and allocating system resources to track and manage add-on peripheral devices, including those capable of producing music, is often time consuming to configure and quite often causes system interrupts during the operation of the host computer.

Attempts have been made in the past to consolidate computer hardware so as to conserve desktop space for the usual core essentials of a computer, namely the central processor unit, monitor, keyboard and pointing device. Most of the past attempts however, at most, consolidate traditional computer hardware and traditional computer multimedia components such as a CD-ROM, a DVD-ROM, a modem, speakers, cameras or microphones. In U.S. Pat. No. 5,892,503 there is disclosed a multimedia console keyboard that combines speakers; microphone; volume control; monitor function control; computer power control switch and integrated analog-to-digital processors. The disclosed device does not alleviate the problem of computer resource allocation associated with adding hardware to a typically configuration computer. The disclosed device attempts to ease the problem by providing analog-digital preprocessors but the device is still dependant on the host computer's resources. The disclosed and consolidated configuration of components

comprise typical multimedia add-on components. U.S. Pat. No. 5,717,430 discloses a multimedia keyboard also. This device too combines traditional computer multimedia components that also require and use resources of the host computer. Each of these disclosed devices uses at least a portion of the host computer's resources when used to play music for the listening pleasure of the computer user. Each device is dependent on the host computer for hardware and software support in order to operate.

The prior art combined keyboard devices merely provide for the consolidation of the typical computer multimedia peripherals, including music producing peripheral device add-ons, into a single unitary keyboard housing without alleviating the problems of: (1) requiring system resources for the operation of the music producing add-on; (2) complicated configuration of the host computer to interface the music producing add-on; and (3) requiring powered operation of the host computer in order to operate the music producing add-on.

SUMMARY OF THE INVENTION

It is therefore an object of this invention to provide a combined computer keyboard and radio apparatus that is conveniently housed in a single computer keyboard housing that operates independently of the host computer to which the combined computer keyboard and radio apparatus is interfaced.

It is also an object of the present invention to provide a combined computer keyboard and radio apparatus that is controlled independently of the host interface computer, thereby obviating the allocation of host interface computer system resources for the operation of the combined computer keyboard and radio apparatus yet providing radio reception and playback for the listening enjoyment of the computer user without risk of impacting the operation of the computer.

It is also an object of the present invention to provide a device that may be used notwithstanding whether the host computer is in the operational on state.

It is a further object of this invention to provide a combined computer keyboard and radio apparatus that is easy to control yet ergonomically elegant in design and function.

It is a further object of this invention to provide a combined computer keyboard and radio apparatus that is capable of being powered by a source independent of the host computer or instead by conveniently drawing minimal power from the host computer.

It is a further object of this invention to provide a combined computer keyboard and radio apparatus that does not compromise the operation of the host computer.

It is a further object of this invention to provide a combined computer keyboard and radio apparatus that can be readily retrofitted to preexisting computer systems easily without resorting to using tools, software or other hardware modifications.

It is a further object of this invention to provide a combined computer keyboard and radio apparatus that is easy to use and manufacture, as well as cost effective.

This invention results from the realization that a convenient, easy-to-use and highly adaptable combined computer keyboard and radio apparatus can be effectuated by combining a computer keyboard and radio receiver within a single unitary housing, wherein the radio receiver's circuitry is totally independent from the keyboard or other

3

associated circuitry of the computer system to which the combined computer keyboard and radio apparatus is interfaced. The combined computer keyboard and radio apparatus is conveniently mounted in a computer keyboard housing having alphanumeric keys arranged in the traditional and customary location and spacing. The combined computer keyboard and radio apparatus also has speakers that are also housed within the single computer keyboard housing as the radio.

This invention features a combined computer keyboard and radio apparatus comprising a computer keyboard housing having alphanumeric keys mounted therein; a radio receiver located within the keyboard housing and at least one speaker for outputting the radio frequencies tuned by the radio receiver. The combined computer keyboard and radio apparatus further comprises a radio receiver having associated audio control circuitry for controlling the bass, treble, volume and other aspects of the sound reproduced by the radio. The radio unit further includes an antenna for improved reception of radio frequency waves. The combined computer keyboard and radio apparatus also features a display means for providing useable information to a user so that the user may selectively control the features of the radio such as on/off, volume, station memory setting and presets, and alarm clock functions. The combined computer keyboard and radio apparatus may be powered exclusively by a battery source isolated from and independent of the computer's power source or alternatively the combined computer keyboard and radio apparatus may derive its minimal power needs from the convenient power circuitry controlling the keyboard.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a depiction of a prior art computer system, showing a typical configuration of such a system;

FIG. 1a is a depiction of the computer keyboard of the prior art computer system;

FIG. 2 is a perspective view of the preferred embodiment of the combined computer keyboard and radio apparatus of the present invention;

FIG. 3 is a detailed depiction of the power source select switch thereof, and FIG. 4 is a detailed view of the radio receiver unit thereof;

FIG. 5 is a depiction of the present invention showing the rear edge of the keyboard housing, including the battery compartment located thereon.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, a prior art computer system configuration 70 is depicted. The prior art computer system 70 includes a monitor 50, a CPU 55, a keyboard 60, a pointing device 65. Also shown are two speakers, 66 and 67, that are each interfaced to the CPU 55 for playing audio. It should be noted that the speakers 66 and 67 each require placement space. The speakers 66 and 67 generally must also be recognized and accounted for by the computer operating system in order for the speakers 66 and 67 to properly operate in a functional mode

FIG. 1a depicts a perspective view of the prior art keyboard 60. The layout and number of alphanumeric keys located on the keyboard 60 is the typical and most common configuration for a computer keyboard. The likelihood of computer user acceptance of any improved keyboard is greatly increased if the improved keyboard maintains the

4

traditional and familiar spacing and configuration of traditional computer keyboards as shown in FIG. 1a.

Now, referring to FIG. 2 is shown a preferred embodiment of the combined keyboard and radio apparatus, depicted generally at 100, of the present invention. It is important and significant to first note that the combined keyboard and radio apparatus 100 of the present invention has a plurality of alphanumeric keys 20 mounted in a keyboard housing 22. The plurality of alphanumeric keys 20 are arranged in a manner similar to the traditional layout and configuration of the alphanumeric keys of the prior art keyboard 60 shown in FIG. 1.

In addition to the traditionally configured alphanumeric keys 20, there is also a radio unit 10 mounted in the keyboard housing 22 of the present invention. As shown, the radio unit 10 is mounted in the keyboard housing 22 in an area of the keyboard housing 22 that usually does not contain alphanumeric keys or other user accessible alphanumeric keys or components. In the preferred embodiment, the radio unit 10 is mounted in the upper right area of the keyboard housing 22, typically above the row of function keys 24. The placement of the radio unit 10 in this area of the keyboard housing 22 is important in so far as the location of the radio unit 10 mounted within the keyboard housing 22 does not alter the traditional and user accustomed configuration of the plurality of alphanumeric keys 20. While the plurality of alphanumeric keys 20 may also be altered to accommodate the placement of the radio unit 10 at most any point on the keyboard housing 22, it is believed that placement of the radio unit 10 in an area of the keyboard housing 22 that traditionally has not supported alphanumeric keys will ease user transition from traditional keyboards to the combined keyboard and radio apparatus of the present invention and also minimize changes to the manufacturing processes required to produce the present invention

Although mounted in the keyboard housing 22 along with the plurality of alphanumeric keys 20, the radio unit 10 is preferably electrically isolated and independent of any keyboard circuitry. Save for the radio unit 10 optionally receiving operational power from the voltage source powering the keyboard circuitry, the radio unit 10 is electrically isolated from all keyboard circuitry. The electrically isolated radio unit 10 can thus operate without reliance on the operation of the computer to which the combined keyboard and radio apparatus 100 is interfaced. The radio unit 10 is normally and in most embodiments at least optionally powered from a battery source 28 that is independent of the keyboard, the CPU and any associated circuitry of those or other components associated with the computer to which the combined keyboard and radio apparatus 100 is interfaced.

The battery source 28 is shown in FIG. 5. The batteries of the battery source 28 are housed in battery compartment 26 located along the rear edge of the keyboard housing in the preferred embodiment. Typically, the radio unit 10 requires very little power to functionally operate. The preferred embodiment of the radio unit 10 can typically be powered by two 1.5 v, size AA batteries that are commercially available from a multitude of manufacturers. The power source is not limited to the preferred embodiments listed herein and may be supplied by any number of power supply sources and types known to those skilled in the art of electronics, including but not limited to an independent and separate AC or AC to dc power transformer, solar power, etc.

With reference to FIG. 2, there is a power source select switch 8 located along the right side outer edge of the keyboard housing 22. A clearer understanding of the power

5

source select switch 8 may be had by referring to FIG. 3. The preferred embodiment of the present invention may be powered from the battery source 28 or in the alternative, from the power supply powering the keyboard circuitry. The keyboard circuitry is powered from the separately located CPU via a control and signal cable 30. The voltage necessary to power the radio unit 10 may be greater than or less than the power required by the keyboard circuitry, therefore the incoming keyboard voltage may have to be amplified or divided, respectfully, in order to obtain the requisite supply voltage required by the radio unit 10. In the preferred embodiment, the voltage required by the radio unit 10 is less than the voltage supplied by to the keyboard circuitry via the control and signal cable 30. A voltage divider circuit is used to get the requisite voltage for the radio unit 10. The manner in which the voltage powering the radio unit 10 is derived from the keyboard circuitry may be accomplished by using a variety of circuits and components, as is known in the art. Therefore, the manner in which the voltage for powering the radio unit 10 is obtained from the keyboard circuitry is not to be limited by the above preferred disclosure.

The radio unit 10 of the preferred embodiment typically has a number of features and controls by which the user can control and thus enhance their radio listening pleasure. The radio unit 10 typically has a display means for displaying information to the user in an understandable format. The radio unit 10 and its associated display means 40, may be better understood by referring to FIG. 4. The radio unit 10 of the preferred embodiment provides users of new and existing computers using this invention the ability to enjoy AM and FM band frequency stations. The radio unit 10 features (1) a digital tuner, including station presets and memory recall functions of the station presets; (2) a selectively settable clock, including alarm functions; (3) audio reproduction quality controls, such as but not limited to tone, bass and treble; (4) mono/stereo selection functions; (5) a distance(DX)/Local tuner sensitivity selection function; and (6) volume control, including a mute function. The volume 32 and DX/Local receiver sensitivity 34 controls are located on the right side edge of the keyboard housing 22 instead of being controlled by controls located on the radio unit 10. The radio unit 10 has control buttons 46 for selectively controlling and setting the features of the radio unit 10. Particular features of the radio unit 10 may be selected and variably changed by manipulation of the control buttons 46. The set values of the various features are displayed by the display means 40. A pair of buttons, 42 and 44 are provided to allow increasing via button 42, or decreasing via button 44, the value of selected functions.

The display means 40 comprises a LCD in the preferred embodiment. The display means may however take the form of LED's, an analog readout or other display means as are known by those skilled in the art.

Also provided along the right side of the keyboard housing 22 is a headphone jack 6, as shown in FIG. 2. Typically, the headphone jack 6 is a 3.5 millimeter(mm) mini-jack and is commonly known to those skilled in the art. The headphone jack is provided for the private listening pleasure of the combined keyboard and radio apparatus 100 user. The headphone jack 6 is connected to the radio unit's output that feeds a pair of speakers 2 and 4 located in the keyboard housing. Interrupt circuitry is provided with the headphone jack wherein connecting headphones or external speakers to the headphone jack 6 interrupts the signal output to the speakers and only provides the output from the radio unit 10 to headphone jack 6.

As such the method of making and using the device detailed above constitutes the inventor's preferred embodi-

6

ment and alternate embodiments to the invention. The inventor is aware that numerous configurations of the device as a whole or some of its constituent parts are available which would provide the desired results. While the invention has been described and illustrated with reference to specific embodiments, it is understood that these other embodiments may be resorted to without departing from the invention. By way of example, the invention may be adapted to be used in a combined keyboard and radio apparatus that communicates with the CPU via wireless communication means or alternatively in a laptop keyboard. Therefore the form of the invention set out above should be considered illustrative and not as limiting the scope of the following claims.

What I claim is:

1. A combined computer keyboard and radio apparatus for use with a computer having a CPU contained in a housing comprising:

a keyboard housing wherein said keyboard housing is separate from the computer CPU housing and a plurality of alphanumeric keys are mounted in said keyboard housing;

a selectively tunable radio unit located in said keyboard housing wherein said radio unit receives radio frequency waves;

at least one speaker mounted within said keyboard housing for audibly reproducing the radio frequency waves received by said radio unit;

a cable interconnecting the combined keyboard and radio apparatus and the CPU wherein a plurality of wires comprises said cable, wherein at least one of said plurality of wires provides power for said radio unit; and

a battery source located within said combined keyboard and radio apparatus housing for providing power to said radio unit, wherein power for said radio unit is selectively switchable between said battery source located in the combined keyboard and radio apparatus housing and at least one of said plurality of wires comprising said cable interconnecting the combined keyboard and radio apparatus and the computer CPU providing power to said radio unit by a switch mounted on said keyboard housing.

2. The combined keyboard apparatus of claim 1 wherein the combined keyboard and radio apparatus communicates with the CPU via wireless communication means.

3. The combined keyboard and radio apparatus of claim 1 further including two speakers mounted in said keyboard housing.

4. The combined keyboard and radio apparatus of claim 3 further including a selectively switchable switch for interrupting the function of said two speakers.

5. The combined keyboard and radio apparatus of claim 1 wherein said radio unit further includes digital tuning means.

6. The combined keyboard and radio apparatus of claim 1 wherein said radio unit further includes display means for displaying clock and radio functionals.

7. The combined keyboard and radio apparatus of claim 1 wherein said radio unit further includes a selectively settable clock.

8. The combined keyboard and radio apparatus of claim 1 further including a headphone jack mounted on said keyboard housing for connecting said radio unit to external headphones and speakers.

9. The combined keyboard and radio apparatus of claim 8 further including an interrupt circuitry connected to said

7

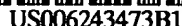
headphone jack for interrupting function of said at least one speaker when headphones and external speakers are connected to said headphone jack.

10. The combined keyboard and radio apparatus of claim 1 further including a selectively switchable switch for interrupting the function of said at least one speaker. 5

8

11. The combined keyboard and radio apparatus of claim 1 wherein said radio receiver further includes an audio control circuitry for selectively varying the audio response of said radio receiver.

* * * * *



(10) Patent No.: US 6,243,473 B1
(45) Date of Patent: Jun. 5, 2001

- (58) **Field of Search** 381/152, 184,
381/423, 426, FOR 162, FOR 163, 431;
361/681, 682, 683; 181/167

- (56)
- References Cited**

- U.S. PATENT DOCUMENTS

- | | | | | |
|-----------|---|---------|---------------------|--------|
| 3,247,925 | • | 4/1966 | Warnaka . | |
| 3,347,335 | | 10/1967 | Watters et al. | 181/05 |
| 5,025,474 | | 6/1991 | Tanaka et al. | 381/90 |
| 5,347,630 | • | 9/1994 | Ishizawa et al. . | |
| 5,638,456 | • | 6/1997 | Conley et al. . | |

- ## FOREIGN PATENT DOCUMENTS

- 4-140999 * 5/1992 (JP) .
WO 95/31805 11/1995 (WO) .

- * cited by examiner

- Primary Examiner—Curtis Kuntz*

- Assistant Examiner—P. Dabney**

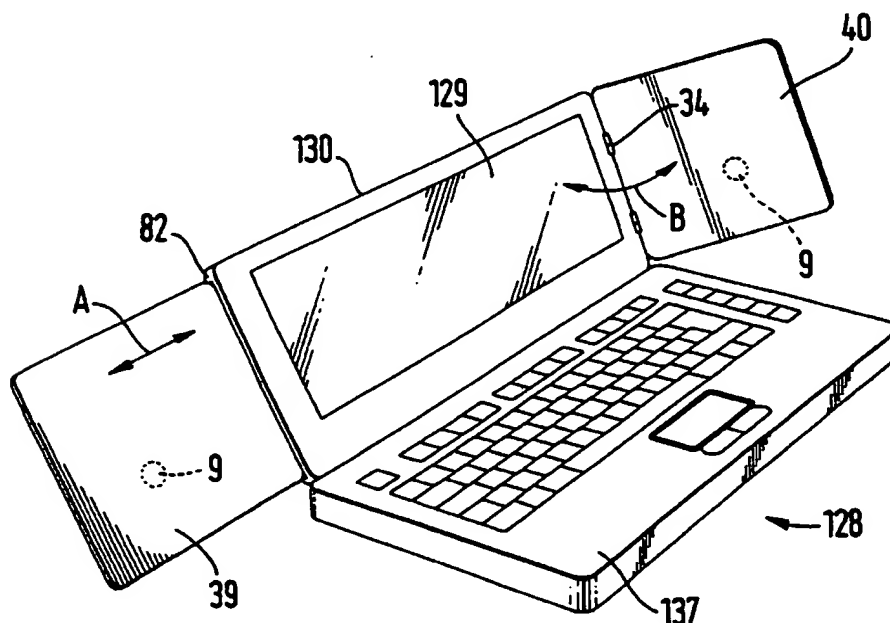
- (74) *Attorney, Agent, or Firm*—Foley & Lardner

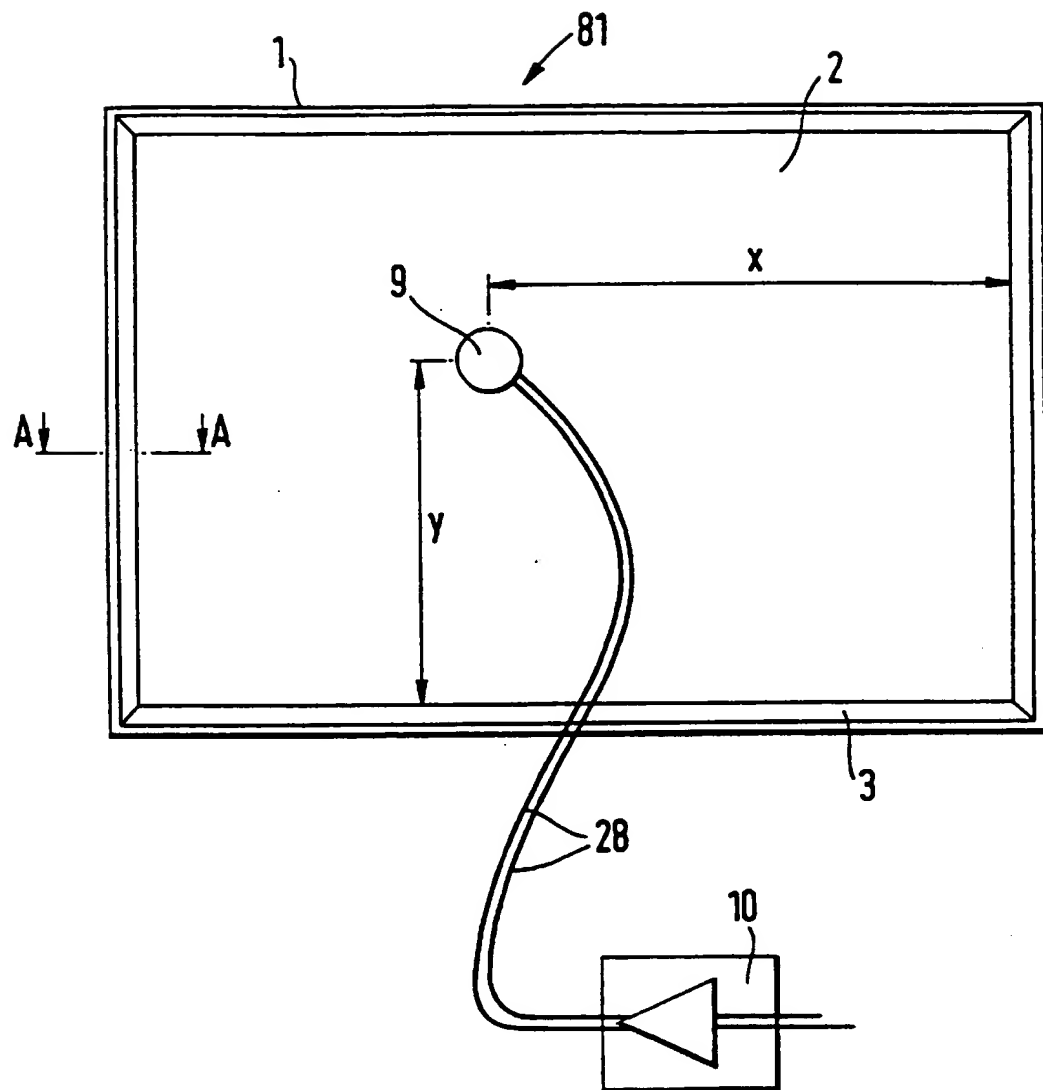
- (57) **ABSTRACT**

- A lap-top computer (128) comprising a combined keyboard (137) and display screen (129), characterised by an opposed pair of loudspeakers (39, 40) attached to the computer, and in that each loudspeaker comprises a distributed mode acoustic radiator having a transducer (9) wholly and exclusively mounted thereon to vibrate the radiator to cause it to resonate.

- 2 Claims, 3 Drawing Sheets**

- (52) U.S. Cl. 381/152; 381/423; 361/681;
181/167



*Fig. 1*

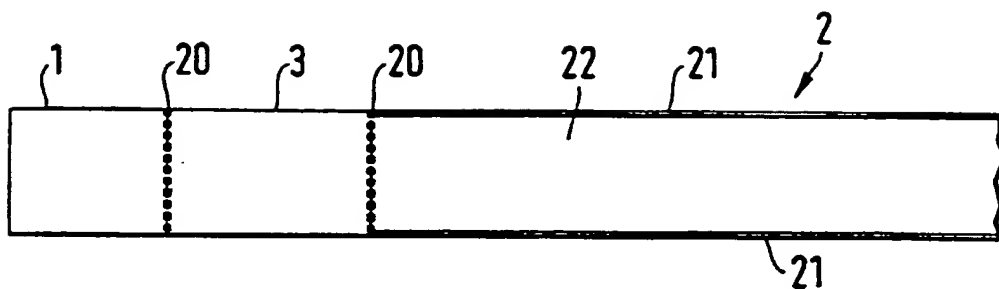


Fig. 2a

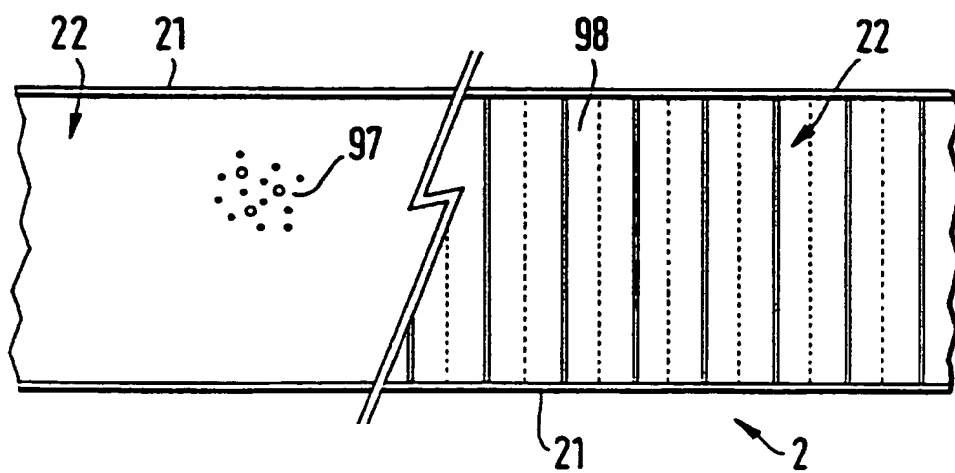


Fig. 2b

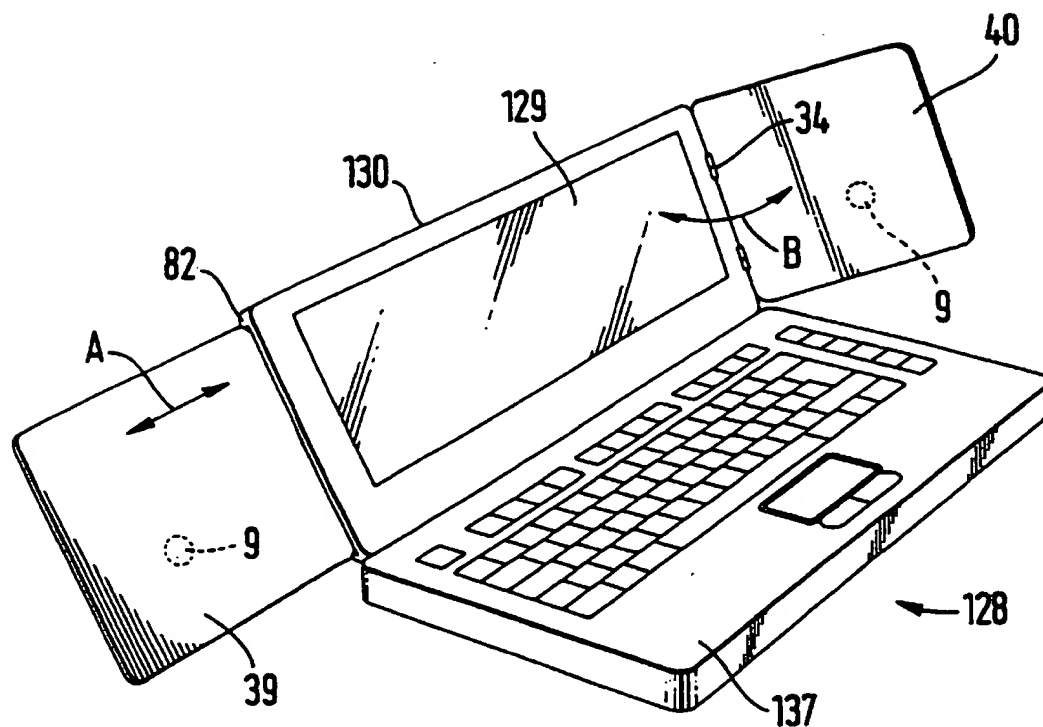


Fig.3

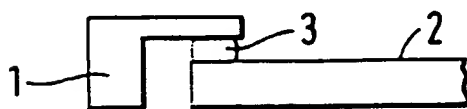


Fig.4

1

LAPTOP COMPUTER WITH LOUDSPEAKER (S)

TECHNICAL FIELD

The invention relates to personal computers and more particularly to lap-top personal computers incorporating loudspeakers.

BACKGROUND ART

It is known from GB-A-2262861 to suggest a panel-form loudspeaker comprising:

- a resonant multi-mode radiator element being a unitary sandwich panel formed of two skins of material with a spacing core of transverse cellular construction, wherein the panel is such as to have ratio of bending stiffness (B), in all orientations, to the cube power of panel mass per unit surface area (μ) of at least 10;
- a mounting means which supports the panel or attaches to it a supporting body, in a free undamped manner;
- and an electro-mechanical drive means coupled to the panel which serves to excite a multi-modal resonance in the radiator panel in response to an electrical input within a working frequency band for the loudspeaker.

DISCLOSURE OF INVENTION

Embodiments of the present invention use members of nature, structure and configuration achievable generally and/or specifically by implementing teachings of our co-pending PCT publication No. WO97/09842 of even date herewith. Such members thus have capability to sustain and propagate input vibrational energy by bending waves in operative area(s) extending transversely of thickness often but not necessarily to edges of the member(s); are configured with or without anisotropy of bending stiffness to have resonant mode vibration components distributed over said area(s) beneficially for acoustic coupling with ambient air; and have predetermined preferential locations or sites within said area for transducer means, particularly operationally active or moving part(s) thereof effective in relation to acoustic vibrational activity in said area(s) and signals, usually electrical, corresponding to acoustic content of such vibrational activity. Uses are envisaged in co-pending International publication No. WO97/09842 of even date herewith for such members as or in "passive" acoustic devices without transducer means, such as for reverberation or for acoustic filtering or for acoustically "voicing" a space or room; and as or in "active" acoustic devices with transducer means, such as in a remarkably wide range of sources of sound or loudspeakers when supplied with input signals to be converted to said sound, or in such as microphones when exposed to sound to be converted into other signals.

This invention is particularly concerned with active acoustic devices e.g. in the form of loudspeakers for personal lap-top computers.

Members as above are herein called distributed mode acoustic radiators and are intended to be characterised as in the above PCT application and/or otherwise as specifically provided herein.

From one aspect the invention is a lap-top computer comprising a keyboard and a display screen, characterised in that the display screen comprises a member having capability to sustain and propagate input vibrational energy by bending waves in at least one operative area extending transversely of thickness to have resonant mode vibration components distributed over said at least one area and have

2

predetermined preferential locations or sites within said area for transducer means and having a transducer mounted wholly and exclusively on said member at one of said locations or sites to vibrate the member to cause it to resonate forming an acoustic radiator which provides an acoustic output when resonating.

From another aspect the invention is a lap-top computer comprising a keyboard and display screen, characterised by an opposed pair of panel-form loudspeakers, and in that each loudspeaker comprises a member having capability to sustain and propagate input vibrational energy by bending waves in at least one operative area extending transversely of thickness to have resonant mode vibration components distributed over said at least one area and have predetermined preferential locations or sites within said area for transducer means and having a transducer mounted wholly and exclusively on said member at one of said locations or sites to vibrate the member to cause it to resonate forming an acoustic radiator which provides an acoustic output when resonating. The loudspeakers may be mounted to the display screen. Thus the loudspeakers may be hinged to the display screen. Alternatively the display screen may comprise a housing and the loudspeakers may each be housed in a slot in the display screen housing for sliding movement between a stored position, in which the loudspeakers are substantially wholly housed in the slot, and a use position in which the loudspeakers are positioned on opposite sides of the display screen. Each radiator may comprise a stiff lightweight panel having a cellular core sandwiched by opposed skin layers. The radiator may be supported in a surrounding frame. A resilient suspension may support the radiator in the frame.

BRIEF DESCRIPTION OF DRAWINGS

The invention is diagrammatically illustrated, by way of example, in the accompanying drawings, in which:

FIG. 1 is a diagram showing a distributed-mode loudspeaker as described and claimed in our co-pending International publication No. WO97/09842;

FIG. 2a is a partial section on the line A—A of FIG. 1;

FIG. 2b is an enlarged cross-section through a distributed mode radiator of the kind shown in FIG. 2a and showing two alternative constructions;

FIG. 3 is a diagram of a perspective diagram of an embodiment of lap-top computer according to the present invention, and

FIG. 4 is a partial cross-sectional view of a detail of FIG. 3.

BEST MODES FOR CARRYING OUT THE INVENTION

Referring to FIG. 1 of the drawings, there is shown a panel-form loudspeaker (81) of the kind described and claimed in our co-pending International publication No. WO97/09842 of even date herewith comprising a rectangular frame (1) carrying a resilient suspension (3) round its inner periphery which supports a distributed mode sound radiating panel (2). A transducer (9) e.g. as described in detail with reference to our co-pending International publication Nos. WO97/09859, WO97/09861, WO97/09858 of even date herewith, is mounted wholly and exclusively on or in the panel (2) at a predetermined location defined by dimensions x and y, the position of which location is calculated as described in our co-pending International publication No. WO97/09842 of even date herewith, to launch bending waves into the panel to cause the panel to resonate to radiate an acoustic output.

The transducer (9) is driven by a signal amplifier (10), e.g. an audio amplifier, connected to the transducer by conductors (28). Amplifier loading and power requirements can be entirely normal, similar to conventional cone type speakers, sensitivity being of the order of 86–88dB/watt under room loaded conditions. Amplifier load impedance is largely resistive at 6 ohms, power handling 20–80 watts. Where the panel core and/or skins are of metal, they may be made to act as a heat sink for the transducer to remove heat from the motor coil of the transducer and thus improve power handling.

FIGS. 2a and 2b are partial typical cross-sections through the loudspeaker (81) of FIG. 1. FIG. 2a shows that the frame (1), surround (3) and panel (2) are connected together by respective adhesive-bonded joints (20). Suitable materials for the frame include lightweight framing, e.g. picture framing of extruded metal e.g. aluminium alloy or plastics. Suitable surround materials include resilient materials such as foam rubber and foam plastics. Suitable adhesives for the joints (20) include epoxy, acrylic and cyano-acrylate etc. adhesives.

FIG. 2b illustrates, to an enlarged scale, that the panel (2) is a rigid lightweight panel having a core (22) e.g. of a rigid plastics foam (97) e.g. cross linked polyvinylchloride or a cellular matrix (98) i.e. a honeycomb matrix of metal foil, plastics or the like, with the cells extending transversely to the plane of the panel, and enclosed by opposed skins (21) e.g. of paper, card, plastics or metal foil or sheet. Where the skins are of plastics, they may be reinforced with fibres e.g. of carbon, glass, Kevlar (RTM) or the like in a manner known per se to increase their modulus.

Envisaged skin layer materials and reinforcements thus include carbon, glass, Kevlar (RTM), Nomex (RTM) i.e. aramid etc. fibres in various lays and weaves, as well as paper, bonded paper laminates, melamine, and various synthetic plastics films of high modulus, such as Mylar (RTM), Kapton (RTM), polycarbonate, phenolic, polyester or related plastics, and fibre reinforced plastics, etc. and metal sheet or foil. Investigation of the Vectra grade of liquid crystal polymer thermoplastics shows that they may be useful for the injection moulding of ultra thin skins or shells of smaller size, say up to around 30 cm diameter. This material self forms an orientated crystal structure in the direction of injection, a preferred orientation for the good propagation of treble energy from the driving point to the panel perimeter.

Additional such moulding for this and other thermoplastics allows for the mould tooling to carry location and registration features such as grooves or rings for the accurate location of transducer parts e.g. the motor coil, and the magnet suspension. Additional with some weaker core materials it is calculated that it would be advantageous to increase the skin thickness locally e.g. in an area or annulus up to 150% of the transducer diameter, to reinforce that area and beneficially couple vibration energy into the panel. High frequency response will be improved with the softer foam materials by this means.

Envisaged core layer materials include fabricated honeycombs or corrugations of aluminium alloy sheet or foil, or Kevlar (RTM), Nomex (RTM), plain or bonded papers, and various synthetic plastics films, as well as expanded or foamed plastics or pulp materials, even aerogel metals if of suitably low density. Some suitable core layer materials effectively exhibit usable self-skinning in their manufacture and/or otherwise have enough inherent stiffness for use without lamination between skin layers. A high performance cellular core material is known under the trade name 'Roha-

cell' which may be suitable as a radiator panel and which is without skins. In practical terms, the aim is for an overall lightness and stiffness suited to a particular purpose, specifically including optimising contributions from core and skin layers and transitions between them.

Several of the preferred formulations for the panel employ metal and metal alloy skins, or alternatively a carbon fibre reinforcement. Both of these, and also designs with an alloy Aerogel or metal honeycomb core, will have substantial radio frequency screening properties which should be important in several EMC applications. Conventional panel or cone type speakers have no inherent EMC screening capability.

In addition the preferred form of piezo and electro dynamic transducers have negligible electromagnetic radiation or stray magnet fields. Conventional speakers have a large magnetic field, up to 1 meter distant unless specific compensation counter measures are taken.

Where it is important to maintain the screening in an application, electrical connection can be made to the conductive parts of an appropriate DML panel or an electrically conductive foam or similar interface may be used for the edge mounting.

The suspension (3) may damp the edges of the panel (2) to prevent excessive edge movement of the panel. Additionally or alternatively, further damping may be applied, e.g. as patches, bonded to the panel in selected positions to damp excessive movement to distribute resonance equally over the panel. The patches may be of bitumen-based material, as commonly used in conventional loudspeaker enclosures or may be of a resilient or rigid polymeric sheet material. Some materials, notably paper and card, and some cores may be self-damping. Where desired, the damping may be increased in the construction of the panels by employing resiliently setting, rather than rigid setting adhesives.

Effective said selective damping includes specific application to the panel including its sheet material of means permanently associated therewith. Edges and corners can be particularly significant for dominant and less dispersed low frequency vibration modes of panels hereof. Edge-wise fixing of damping means can usefully lead to a panel with its said sheet material fully framed, though their corners can often be relatively free, say for desired extension to lower frequency operation. Attachment can be by adhesive or self-adhesive materials. Other forms of useful damping, particularly in terms of more subtle effects and/or mid- and higher frequencies can be by way of suitable mass or masses affixed to the sheet material at predetermined effective medial localised positions of said area.

An acoustic panel as described above is bi-directional. The sound energy from the back is not strongly phase related to that from the front. Consequently there is the benefit of overall summation of acoustic power in the room, sound energy of uniform frequency distribution, reduced reflective and standing wave effects and with the advantage of superior reproduction of the natural space and ambience in the reproduced sound recordings.

While the radiation from the acoustic panel is largely non-directional, the percentage of phase related information increases off axis. For improved focus for the phantom stereo image, placement of the speakers, like pictures, at the usual standing person height, confers the benefit of a moderate off-axis placement for the normally seated listener optimising the stereo effect. Likewise the triangular left/right geometry with respect to the listener provides a further angular component. Good stereo is thus obtainable.

5

There is a further advantage for a group of listeners compared with conventional speaker reproduction. The intrinsically dispersed nature of acoustic panel sound radiation gives it a sound volume which does not obey the inverse square law for distance for an equivalent point source. Because the intensity fall-off with distance is much less than predicted by inverse square law then consequently for off-centre and poorly placed listeners the intensity field for the panel speaker promotes a superior stereo effect compared to conventional speakers. This is because the off-centre placed listener does not suffer the doubled problem due to proximity to the nearer speaker; firstly the excessive increase in loudness from the nearer speaker, and then the corresponding decrease in loudness from the further loudspeaker.

There is also the advantage of a flat, lightweight panel-form speaker, visually attractive, of good sound quality and requiring only one transducer and no crossover for a full range sound from each panel diaphragm.

FIGS. 3 and 4 illustrate a lap-top personal computer (128) having a keyboard (137) and a member (130) incorporating a visual display screen (129) and which member is provided with an opposed pair of loudspeakers (39,40) attached to the visual display member (130) to adapt the computer for multi-media applications and the like.

The loudspeakers (39,40) are formed as thin rectangular panels which as indicated at (39) and by arrow 'A' may be slid from the position of use indicated in the drawing into a storage position in the member (130) through a slot (82). Alternatively, as indicated at (40) and by arrow 'B' the loudspeaker panel may be folded about hinges (34) from the position of use indicated in the drawing to a storage position in which the panel (40) overlies the screen member (130).

Each of the loudspeakers (39,40) is formed as a lightweight multi-mode acoustic radiator of the kind described above with reference to FIGS. 1 and 2. Thus each loudspeaker (39,40) comprises a stiff lightweight panel (2) having a cellular core (22) skinned on both sides with surface sheets (21), the panel (2) being supported at its periphery on a resilient suspension (3) of an elastomeric material which in turn is supported in a lightweight surrounding frame (1), e.g. of plastics. A transducer (9) is mounted on each panel (39,40) at a predetermined position discussed more fully in our co-pending International publication No. WO97/09842, to launch bending waves into the panel (2) to produce an acoustic output. The transducer (9) may be of the kinds described in our co-pending International publication Nos. WO97/09859, WO97/09861, WO97/09858.

A decorative lightweight cover (not shown) may be positioned over the panel (2) surround (3) and frame (1) to obscure the loudspeaker.

6

What is claimed is:

1. In a lap-top computer having a keyboard and a display screen, the improvement wherein the display screen comprises:

a member having selected values of certain physical parameters which enable the member to sustain and propagate input vibrational energy in a predetermined frequency range by a plurality of resonant bending wave modes in at least one operative area extending transversely of thickness such that the frequencies of the resonant bending wave modes along at least two conceptual axes of the operative area are interleaved and spread so that there are substantially minimal clusterings and disparities of spacings of said frequencies, the member when resonating having at least one site at which the number of vibrationally active resonance anti-nodes is relatively high; and

a transducer mounted wholly and exclusively on the member at one of said sites on the member, the transducer being capable of vibrating the member in the predetermined frequency range to couple to and excite the resonant bending wave modes in the member and cause the member to resonate and produce an acoustic output.

2. In a lap-top computer having a keyboard and a display screen, the improvement comprising:

an opposed pair of panel form loudspeakers attached to the display screen for operation in a predetermined frequency range, each loudspeaker comprising:

a member having selected values of certain physical parameters which enable the member to sustain and propagate input vibrational energy in a predetermined frequency range by a plurality of resonant bending wave modes in at least one operative area extending transversely of thickness such that the frequencies of the resonant bending wave modes along at least two conceptual axes of the operative area are interleaved and spread so that there are substantially minimal clusterings and disparities of spacings of said frequencies, the member when resonating having at least one site at which the number of vibrationally active resonance anti-nodes is relatively high; and

a transducer mounted wholly and exclusively on the member at one of said sites on the member, the transducer being capable of vibrating the member in the predetermined frequency range to couple to and excite the resonant bending wave modes in the member and cause the member to resonate and produce an acoustic output.

* * * * *